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ABSTRACT

Ethnobotany is the study of the relationships between plants and people. Ethnobotanists study a large range of interests related to indigenous populations, including the use of plants for foodstuffs, medicines, dyes, transportation, clothing, shelter, and ritual. The Navajo, like other indigenous groups, have developed a wealth of knowledge about the local fauna which have led to the following: medicines used in sacred ceremonies and for the treatment of a variety of ailments for both man and animal; dyes used in the coloring of wool for rugs; nutritionally rich leaves, roots, stems, and fruits to supplement their diets; and materials for the construction of shelter and utilitarian goods. This paper reviews an ethnobotany unit that utilizes the valuable science content contained in the ethnobotany of the Navajo. This interdisciplinary approach helps develop deeper understanding of the relationships of culture to the environment. Also included is a list of resources for acquiring general knowledge about ethnobotany. (JRH)

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Using Ethnobotany as a Topic to Make Connections Between Culture and Science

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My science students, who were mostly Navajo, were intently listening to the Navajo Medicineman (or on other occasions the Medicinewoman) who had come to my class to lead a field trip on traditional uses of the indigenous plants of our area. Since he primarily spoke Navajo one of my bilingual students translated for the non-Navajo speakers including the humorous remarks such as "this is a good plant for *amasani* (a grandmother) to put in the tea of *bihastiin* (her husband), if he has been unfaithful". On a more serious side he is a litany of knowledge—a professional herbalist—demonstrating what plant parts are edible, which ones were used for dyes or for healing ceremonies and how each should be prepared for these purposes. In a very subtle way he also taught them to value all living things by admonishing them to pick only the amount of plant material that was needed and to return some seeds onto the ground to insure that this plant would have the opportunity to flourish once more on this spot. The visit of a local resource person was one of number of activities related to Ethnobotany that I used as part of a year long Outdoor Science course designed for my Navajo reservation high school. The major purpose of this course was to demonstrate to my students the value of making connections between traditional tribal science knowledge

and western science with the hope of sparking increased interest in science for this predominately Navajo student population. This article will overview this Ethnobotany unit and suggest how science teachers might include similar multicultural concepts into their classrooms.

Ethnobotany is the study of the relationships between plants and people---"ethno", the study of people, and "botany", the study of plants (Balick and Cox, 1996). Ethnobotanists study a large range of interests related to indigenous populations including the use of plants for foodstuffs, medicines, dyes, transportation, clothing, shelter and ritual. Deeper understanding of the relationships of culture to their environment are developed through this interdisciplinary approach as well as potentially very valuable contributions to modern pharmacopoeia. Some classic examples of the multitude of modern drugs derived from indigenous knowledge of plants include *Rauvolfia serpentina*, the snakeroot plant, traditionally used as a sedative in Ayurvedic medicine of India which was the first modern drug used to lower blood pressure and *Cinchona ledgerianna*, a peruvian bark used by the Inca's to treat symptom of malaria, from which quinine was derived.

The Navajo, like other indigenous groups, have developed a wealth of knowledge about the local fauna which have led to medicines used in sacred ceremonies and for treatment of a variety of ailments for both man and animal; dyes used in the coloring of wool for rugs; nutritionally rich leaves, roots, stems and fruits to

supplement their diets and materials for construction of shelter and utilitarian goods.

I utilized the concept that much valuable science content is included in the Ethnobotany of the Navajo and included it as a key unit in the curriculum course for high school students that I called **Outdoor Science.** I believe the use of curriculum topics such as Ethnobotany that bridge culture and science can result in greater success in the teaching and learning of not only American Indian students, for whom this was developed, but also in a variety of other cultural contexts.

How does a science teacher gain local, specific as well as broad general knowledge about Ethnobotany? The broader, general knowledge can be acquired through a number of growing and expanding references on the topic (see Reference list) and even more recently on internet web sites. In order for a science teacher to gain specific local or regional knowledge about indigenous botany he (she) must be open to learn from students, tribal experts, books and other sources and then creatively integrate this knowledge into the more standard science curriculum. This is a dynamic process as the teacher, students and community interact over time.

One specific example that demonstrates this technique includes linking chemical extraction techniques and the study of bacteriology to the effectiveness of Navajo herbs as anti-bacterial agents. Navajo herbalists or medicinemen are invited to become an integral part of the instruction by coming into the classroom to teach students and teachers the names, locations and key parts of Navajo medicine

plants (as alluded to in the introduction). Resource books such as *Nanise'* (*Plants* in Navajo) are also available as reference guides for the students. Building on this knowledge of indigenous plant usage, imparted from Navajo herbalists, students learn how to perform chemical extraction of active reagents from plant parts. A good reference for this process is available from *World Outdoor Life Science* (Killackey, 1988) on pages 41-52. Following extraction of the assumed active reagents, students design controlled experiments to check for their effectiveness compared to commonly used antibiotics such as penicillin, by applying typical bacteriological techniques (see World Outdoor Life Science, p.53-75). From student experiments, many of these extracts were found to be just as effective at killing bacteria as penicillin and other commercial antibiotic agents. In this exercise students were not only learning and applying valuable western science processes such as observation, designing experiments, forming hypotheses and drawing conclusions but also deriving information about their own tribal science knowledge through the use of the community resources.

Another example from the Ethnobotany unit that used this same process of linking western science concepts to tribal science was the study of Navajo rug dyes. Navajo women are known world wide for their naturally dyed wool rugs. Some local Navajo weavers were brought into the class to teach both students and teachers tribal knowledge about the collection, preparation and application of appropriate plant materials to the dyeing of wool (see Young, 1978). Guided by the weavers, students would be actively involved in this entire process. Each student team was responsible to produce wool

specimens yielding a variety of distinct color patterns. Formation of the appropriate colors involved a number of variables including amount and type of plant materials, amount of time spent boiling, concentration of the extract and time applying dye to the wool. All of these involve application of chemical principles of extraction, boiling and solution concentrations. Weavers evaluated the student success of these outcomes through intrinsic observational standards developed over years of experience. During this process they often would offer much support to student progress while gently chiding them on ways to improve.

Other activities and assessments utilized during the unit included preparation of traditional Navajo meals that incorporate indigenous plant material (including determining nutritional and caloric content); preparation of an indigenous plant portfolio which included information on Navajo, scientific and common names and uses; and a culminating field test on all of these concepts. In addition, some chose some aspect of ethnobotany to do a research project for the local and regional science fairs. See figure 1 for an outline of the entire unit on Ethnobotany.

My students expressed genuine enthusiasm for this approach. They felt that it truly makes science real for them by using elements of local tribal science applied to western science processes. Other evidence of support for this approach from my own observations include:

1) Student enrollment in the **Outdoor Science** elective course increased from 10 students in the first class to five sections of 20-25 students within five years.
2) Student enrollment in 'hard science' courses like chemistry and physics increased 50-75% during this time period primarily drawing from students who had taken Outdoor Science.
3) Grade point averages for students in this course averaged 3.5 compared to 2.3 in other more traditional courses.
4) An increasing number of students that took the course have and are presently pursuing medical, engineering and other technical/scientific degrees---significantly higher than the period prior to the course.

In a more formal context, research has shown that when tribal cultural science components are incorporated into courses, American Indians' attitudes, achievement and self-esteem tend to increase (Keating, 1992; Keating, 1996 and Killackey, 1989).

Although this Ethnobotany unit was developed specifically for American Indian students, many of the activities could easily be modified for other cultural groups. Most cultures have used plants for specific foods, medicines and other purposes with obvious scientific connections. One of the roles of the teacher in this process is to appraise the cultural diversity of his (her) class and use this as a strength in formulating a plan of study that includes the use of community resources that can be used as the context to apply western science processes. In addition to the cultural context, the use of teaching strategies such as the use of realia, cooperative groups and hands-on materials, sometimes referred to as sheltered

instruction, all of which were utilized in this unit, have widespread support in that they are considered highly effective for use with studnts from diverse cultural and linguistic backgrounds (Harris, 1995). A curriculum like this based on the cultural background of the students that utilizes both indigenous knowledge as well as western science processes has a strong potential to stimulate interest and improve student performance in science. With the increasing multicultural nature of America's schools, science teachers should consider the possibilities of including similar links in their own classrooms.

note: For information on any of the resources or lab processes outlined in this article contact the author at College of Education, California State University at San Marcos, San Marcos, CA. 92096or tele: 6197504321 email: jkeating@mailhost1.csusm.edu

References:

Balick, M. and Cox, P. 1996. *Plants, People, and Culture—The Science of Ethnobotany.* New York: Scientific American Library.

Harris, J. 1995. Sheltered Instruction. The Science Teacher. 62 (2): 24-27.

Killackey, A. 1989. *Affective Results of a bicultural science curricula with American Indian Students.* Unpublished doctoral dissertation, University of New Mexico.

Killackey, A. 1988. *World Outdoor Life Sciences: Teacher's Guide.* Flagstaff, AZ: Northern Arizona University—The Learning Center.

Keating, J. 1992. *Factors that Affect the Success of Navajo High School Students in Science.* Unpublished doctoral dissertation, University of New Mexico.

Keating, J. 1996. *Effectiveness of an Experimental Biology Course that Utilizes Cultural Components to Teach Science.* Unpublished manuscript.

Resources: the following resource list contains some general references on the topic of Ethnobotany as well as some specific ones for use with American Indian or Navajo students.

Angier, B. 1974. *Survival With Style.* New York: Vantage Press.

Baker, H.G. 1970. *Plants and Civilization.* 2nd Edition. Belmont, CA: Wadsworth Publishing Company.

Balick, M. and Cox, P. 1996. *Plants, People, and Culture—The Science of Ethnobotany.* New York: Scientific American Library.

Barba, R. 1995. *Science in the Multicultural Classroom.* Boston: Allyn and Bacon.

Becktell, M. 1986. *The Adult Navajo Learner: Learning styles and corresponding teaching strategies.* Unpublished manuscript.

Benally, H. 1992. *Navajo Ways of Knowing.* Tsailie, AZ.: Navajo CC Press.

Bingham, S. and Bingham, J. 1979. *Navajo Farming.* Chinle, AZ: Rock Point Community School Press.

Cajete, G. 1994. *Look to the Mountains—An Ecology of Indigenous Education.* Durango, CO: Kivaski Press.

Densmore, F. 1974. *How Indians Use Wild Plants for Food, Medicine and Crafts.* New York: Dover Publications.

Heiser, C.B. 1985. *Of Plants and People.* Norman, OK: University of Oklahoma Press.

Killackey, A. 1988. *World Outdoor Life Sciences: Teacher's Guide.* Flagstaff, AZ: Northern Arizona University—The Learning Center.

Mayes, V. and Lacy, B. 1989. *Nanise'—A Navajo Herbal.* Tsailie, AZ.: Navajo C.C. Press.

Martin, G.L. 1995. *Ethnobotany: A Methods Manual.* London: Chapman and Hall.

Nelson, R. 1977. *Handbook of Rocky Mountain Plants.* Estes Park, CO: Skyland Publishers.

Olsen, L. 1973. *Outdoor Survival Skills.* Provo: BYU Press.

Patraw, P. 1970. *Flowers of the Southwest Mesas.* Globe, AZ.: Southwest Parks and Monument Association.

Plotkin, M. 1993. *Tales of a Shaman's Apprentice.* New York: Penguin Book.

Wilkerson, J. 1975. *Medicine for Mountaineering.* Seattle: Craftsman and Met Press, Printers.

Young, S. 1978. *Navajo Native Dyes.* Palmer Lake, Co: The Filter Press.

Figure 1.

Ethnobotany Unit (First Semester)

Time Frame: Approximately six weeks

Objectives: The student will be able to demonstrate and apply knowledge of...

1) indigenous plants including common, scientific and Navajo names and application to medicine/food/dyes through various projects, experiments, field exam and a plant portfolio.
2) the scientific method by formulating a mini-research project that may be related to topic of Ethnobotany.
3) specific indigenous plants through the collection and preparation of them as well as the analysis of their nutritional value.

Activities:

1. Group identification (Navajo, common, and scientific names) and usage of local indigenous plants through field studies using local herbalist's and reference guides.
2. Preparation of rug dyes from indigenous plants and their application to wool through the assistance of a Navajo rug weaver.
4. Construction of an indigenous plant portfolio.
5. Preparation, cooking, eating of a traditional meal that includes native plants.
6. Viewing of videos and presentations by local tribal guest speakers related to the preservation of native plants and local habitats (such as the rain forests and desert).
7. Lab experiments and projects related to various aspects of Ethnobotany including extraction and testing of medicinal (antibacterial) properties of Navajo (American Indian) plants.

Assessment:

1. The quality of the rug dyes as seen in their application to wool based on a determination by expert rug weavers.
2. Completeness and accuracy of native plant portfolio collection. (that includes for example correct use of Navajo, common, and scientific names with their corresponding appropriately applied uses).
3. Effectiveness of group preparation of native plant foods based on completeness and accuracy of each presentation.

4. Evaluation of the application of science processes through lab reports and the written and oral presentations of the mini-research project.